

THE EFFECT OF ANESTHESIA AND OPERATION ON KIDNEY
FUNCTION AS SHOWN BY THE PHENOLSULPHONE-
PHTHALEIN TEST AND URINARY ANALYSIS.

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THE following is a report of the effect of anesthesia and operation on kidney function as demonstrated by the phenolsulphone-phthalein test and urinary analysis performed on 55 cases, selected mainly because of the objections raised to disturbing unnecessarily those cases which were to undergo or had undergone operations for involved intra-abdominal conditions.

The series comprises: 22 cases of hernia, 11 cases of chronic appendicitis, 6 cases of gynecological surgery, 3 cases of varicose veins, 3 cases of hemorrhoids, 3 cases of nephritic origin, 7 miscellaneous cases, as cholecystectomy, gastrectomy, cervical lymphadenectomy, hydrocele, sarcoma of the leg, carcinoma of the breast, and an orchidectomy. The cases were operated upon by the second surgical division of the Presbyterian Hospital.

THE ROUTINE. The routine followed was to have the patient drink four glasses of water, usually at fifteen minute intervals, so as not to cause nausea, and then at the end of the hour previous to the injection, have him void so as to insure the emptiness of the bladder. One cubic centimeter of the phthalein dye was then injected subcutaneously into the triceps region of the arm, and a sample of urine taken every few minutes until the characteristic red color appeared in the urine which had been previously rendered alkaline by the addition of a few drops of a 25 per cent. solution of sodium hydroxide. The time of the first appearance was noted and the urine excreted, collected for that hour, and the succeeding one, in separate bottles. The usual technic of diluting the specimen to 1 liter after it has been alkalinized was followed, and a sample read as soon as possible by the Helliges colorimeter by artificial light, it having been found that the matching of the intensity of color was better made thereby.

In cases in which doubt existed as to bladder retention the patient was always catheterized; in fact, 30 of the 33 males were catheterized at the end of the second hour, and whenever the color did not appear in fifteen minutes, a catheter was introduced, provided that there was urinary retention. The 22 female cases were all catheterized, the catheter being left in the urethra until the test was completed. About thirty-six hours after operation a second injection was made, the only exception being that sometimes the patient was unable to drink the full four glasses of water because of its nauseating effect after operation and anesthesia.

In addition a twenty-four hour specimen of urine was collected before operation and one after, an attempt being made to secure a better view of the activity of the kidney. The specimen was measured and described, its reaction and specific gravity noted, an albumin test performed, and a portion centrifuged and examined especially for casts.

The Anesthetic. The anesthesia employed was ether in 47 cases, given by the Bennet inhaler, previous to which a bag of nitrous oxide was administered; gas and oxygen in 7 cases given by the Luke apparatus; local anesthesia in 1 case with novocain 1 per cent.

THE AVERAGE PITHALEIN EXCRETION.

In 47 ether cases the average ante-operative phthalein was 57.9 per cent. Average p. o. phthalein 57.3 per cent.

Decrease in the number of Fe^{2+} ions $\frac{6}{6}$ "

In the 7 gas and oxygen cases the average age-operative

Average p. o. phthalene was 52.2 per cent.
Average p. o. phthalate was 49.0 ".

Decrease in the number of individuals 32

The Urine Analysis. The urine analysis showed 15 cases having albumin, 2 of which showed casts, or albumin present in 27 per cent. of the cases; of these 10 showed albumin after operation, 6 with casts. Ten cases, previously negative, developed albumin after operation, practically every one of these cases showing many hyaline and finely granular casts, or 25 per cent. of the previously negative urines showed some passing effect of kidney irritation.

EFFECT OF LENGTH OF ETHER ANESTHESIA AND OPERATION ON KIDNEY FUNCTION.

Operations lasting fifteen to twenty-nine minutes:

| | |
|-----------------------------------|----------------|
| Average u. o. phthalein | 52.3 per cent. |
| Average u. o. phthalein | 58.5 " |

Increase in the number of students in the class 62

" cases showed a trace of albumin with casts (postoperative).

10 cases lasting thirty to forty-four minutes;

| | |
|-----------------------------------|----------------|
| Average u. o. phthalein | 58.8 per cent. |
| Average u. g. phthalein | 58.8 " |

No change

4 cases showing albumin, 3 with casts (interpretative).

11 cases lasting forty-five to fifty-nine minutes:

| | | |
|-------------------------|------|-----------|
| Average a. o. phthalein | 58.4 | per cent. |
| Average u. o. phthalein | 57.1 | " |

Resources 13 3

Decrease
7 cases showing albumin 5 with casts (postoperative).

7 cases showing albumin, 3 with cases (posterior)
11 cases lasting nine to seventy-four minutes;

| | |
|-------------------------|----------------|
| Average n. o. phthalein | 58.8 per cent. |
| Average n. o. phthalein | 57.9 " |

— 8 —

Decrease
↑ rates showing aluminum ↑ with casts (postoperative).

4 cases lasting seventy-five to eighty-nine minutes:

| | |
|-----------------------------------|----------------|
| Average a. o. phthalein | 50.8 per cent. |
| Average p. o. phthalein | 40.8 " |

| | |
|--------------------|--------|
| Decrease | 10.0 " |
|--------------------|--------|

3 cases showing albumin with casts (postoperative).

Showing probably that as the length of anesthesia is prolonged the functional activity of the kidney is depressed, while in the shorter cases there is practically no change, perhaps even a mild degree of stimulation.

EFFECT OF AGE AND ANESTHESIA ON KIDNEY FUNCTION.

| | | |
|--|----------------|----------------------|
| Below 20 years, average a. o. phthalein | 64.1 per cent. | p. o. 61.5 per cent. |
| Below 20 to 39 years, average a. o. phthalein 56.0 " | " | p. o. 57.3 " |
| Below 40 to 59 years, average a. o. phthalein 52.8 " | " | p. o. 51.8 " |

Showing mainly that as the age in years increases that the threshold activity of the kidney is diminished.

Effect of Type of Patient and Anesthesia on Kidney Function. That the kidney is affected by psychic influence and individual variation is well known, and it is partially illustrated in the figures given below.

I. Normal or average type:

| | |
|---------------------------|----------------|
| a. o. phthalein | 58.7 per cent. |
| p. o. phthalein | 59.8 " |

| | |
|--------------------|--------|
| Increase | 1.10 " |
|--------------------|--------|

II. Nervous type:

| | |
|---------------------------|----------------|
| a. o. phthalein | 60.5 per cent. |
| p. o. phthalein | 56.0 " |

| | |
|--------------------|-------|
| Decrease | 4.5 " |
|--------------------|-------|

III. Obese type, which, as a rule take anesthesia very poorly with cyanosis:

| | |
|---------------------------|----------------|
| a. o. phthalein | 56.6 per cent. |
| p. o. phthalein | 44.9 " |

| | |
|--------------------|--------|
| Decrease | 11.7 " |
|--------------------|--------|

IV. Anemic type:

| | |
|---------------------------|----------------|
| a. o. phthalein | 55.5 per cent. |
| p. o. phthalein | 46.0 " |

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|--------------------|-------|
| Decrease | 9.5 " |
|--------------------|-------|

V. Arteriosclerotic type:

| | |
|---------------------------|----------------|
| a. o. phthalein | 53.5 per cent. |
| p. o. phthalein | 50.7 " |

| | |
|--------------------|-------|
| Decrease | 2.9 " |
|--------------------|-------|

The Ether Cases Individually. While the averaged ease of ether anesthesia shows but little change the cases considered individually vary considerably one way or the other.

Twenty-two cases showed an increased postoperative phthalein of about 11 per cent. Ante-operative urine examination was negative in 17 of these cases and pathological in 5 cases or 22 per

cent., these 5 cases showing albumin but no casts. The postoperative urine examination of this series was negative in 15 cases, pathological in 7 cases, 3 cases previously having no abnormality now showing albumin, 1 with hyaline casts.

Twenty-two cases showed a decreased postoperative phthalein of about 16 per cent. average. The anteoperative urine examination was negative in 13 of these cases; pathological in 9 or 41 per cent.; 7 of these cases showing a faint trace of albumin, 2 with casts, and 2 cases showing a heavy trace of albumin and no casts. Postoperative urine examination of this series was negative in 8 cases, pathological in 14, 6 cases of the 9 already mentioned showing further changes, 3 cases showing a greater albumin reaction, 4 cases now for the first time showing casts. Eight cases previously showing no urinary change now showed pathological elements, 1 case with a faint trace of albumin with casts, 4 cases with a moderate trace of albumin, 1 with casts, and 3 cases with a heavy trace of albumin, all with casts.

Within this group were 2 cases of nervous temperament which gave no urinary change, but marked phthalein postoperative deficiency; 1 other case was especially cyanotic, and had previously had Magendie solution MvJ , leaving 2 cases which showed a decreased postoperative phthalein with no explanation or rather an attempt at one.

While the series of cases is small, it seems reasonable to suppose that preexisting conditions of albuminuria predispose to a lowering of kidney efficiency as shown by the phthalein test after operation and anesthesia; and that in the majority of cases showing a decrease output, there is an accompanying urinary picture showing the effects of kidney irritation, rather mild in nature. That this is not permanent, is shown by a third phthalein test in 5 of the cases which suffered a severe depression, where in ten days time the kidney output was practically restored to what it was originally, and the urine examination was once more negative, or in the condition it was, before anesthesia.

The Gas and Oxygen Cases. Although there were but 7 cases of gas and oxygen, they show very interesting results.

In 2 cases of anesthesia of thirty-five and forty-five minutes respectively with an ante-operative phthalein of 51 per cent., and a postoperative phthalein of 47 per cent., a decrease of 4 per cent. occurred; one of the patients was of the nervous type and the other was a case of cardiovascular disease.

There were 4 cases of anesthesia of sixty, sixty-six, seventy, and a hundred and ten minutes with the average ante-operative phthalein excretion of 54 per cent., and a postoperative phthalein of 54 per cent., showing in one case only a faint trace of albumin after operation.

The seventh case was an anesthesia of a hundred and fifty minutes

with a decreased output postoperative of 14 per cent., the urine showing a trace of albumin and many hyaline casts.

Comparing this with the results obtained from ether anesthesia, in 3 of the cases which were very nervous, the average ante-operative phthalein was 55 per cent., the postoperative phthalein, 54 per cent., or a difference of 1 per cent. as compared with the difference of 4.5 per cent. in the ether series of nervous patients.

SUMMARY AND CONCLUSIONS. Upon the whole, the average case after thirty-six hours postoperative shows very little change in kidney function as demonstrated by the phenolsulphonephthalein test, although 25 per cent. showed urinary changes, which in ten days time were again negative.

The functional activity of the kidney is depressed as the length of anesthesia is increased, while in short anesthesias the kidney might even appear to be stimulated to a slight degree.

As age increases the threshold activity of the kidney is lessened.

Nervous patients, anemic, obese, and arteriosclerotic patients as a rule, show some effect of their physical or psychic state on kidney function.

Preexisting conditions of albuminuria have a tendency to decreased phthalein excretion, and those cases which have a decreased phthalein excretion, in the majority of instances, show effects of kidney depression as evidenced by careful urinary analysis, although these effects are only temporary.

For long anesthesias and apparently for nervous patients, gas and oxygen as an anesthetic seems to have the least irritating effect on kidney function, as demonstrated especially by urine examination.

AN UNUSUAL DISORDER OF THE CARDIAC MECHANISM RELIEVED BY SURGICAL OPERATION.

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From the two points of view the following case is of interest, as an example, (1) of an unusual type of disordered mechanism of the heart beat, and (2) of the efficacy of removing cryptic or frank sources of reflex damage to the cardiac mechanism.

History. A. R., a married woman, aged fifty-six years, was admitted to the surgical wards of the University Hospital for repair of cystocele and rectocele. On physical examination, however, the pulse was found to be so distinctly irregular that the operation was